

PATENT ABSTRACTS OF JAPAN

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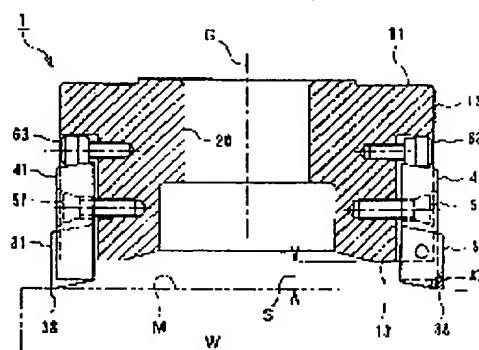
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(54) ROTARY CUTTING TOOL

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a rotary cutting tool capable of preventing chips existing between the bottom surface and a machining surface of a tool body from damaging the machining surface during cutting.

SOLUTION: In the rotary cutting tool 1, a plurality of throw-away tips 31 are clamped to the outer periphery of the tool body 11. A size S of a clearance in the rotation shaft G direction between the lower end 13 of the cutting tool body 11 and the lower end 38 of a cutting edge of the clamped tips 31 is set 3.0-4.5 mm. The clearance is set to be adequately large as long as chattering does not occur in the machining surface, so that the chips are prevented from damaging the machining surface of a work.



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CLAIMS

[Claim(s)]

[Claim 1] The rotation cutting tool characterized by setting the dimension in the direction of a revolving shaft of the lower limit of said body of a rotation cutting tool, and the lower limit of the cutting edge of said clamped throwaway tip to 3.0-4.5mm in the rotation cutting tool with which two or more throwaway tips were clamped by the periphery of the body of a rotation cutting tool.

[Claim 2] Said throwaway tip is a rotation cutting tool according to claim 1 which it is [this clamp hole] unevenly distributed, it is established in the side approach location which counters the side which makes not a core but the bottom cutting edge of a throwaway tip, and fitting of this clamp hole is carried out to the heights of a blade, and is characterized by said throwaway tip being clamped through this blade by said body of a rotation cutting tool while having the clamp hole.

[Claim 3] Said throwaway tip is a rotation cutting tool according to claim 1 or 2 which is the thing which comes to unite with a throwaway tip body the extra-high voltage sintered compact which makes a cutting edge.

[Claim 4] The rotation cutting tool according to claim 3 which is that to which said extra-high voltage sintered compact uses a diamond as a principal component.

[Claim 5] The throwaway tip characterized by it being [this clamp hole] unevenly distributed, and establishing it in the side approach location which counters the side which makes not a core but the bottom cutting edge of a rake face of a throwaway tip in a thing equipped with the clamp hole which is the throwaway tip clamped by the periphery of the body of a rotation cutting tool, and is penetrated to a rake face.

[Claim 6] The throwaway tip characterized by coming to unify the extra-high voltage sintered compact which makes a cutting edge on a throwaway tip body in claim 5.

[Claim 7] The throwaway tip according to claim 6 which is that to which said extra-high voltage sintered compact uses a diamond as a principal component.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the rotation cutting tool used for a face cutter (cutter) etc.

[0002]

[Description of the Prior Art] drawing 6 shows the cross-section structure of this kind of rotation cutting tool (the body of the following and a tool -- or it is also only called a body) 1. As for this tool 1, two or more throwaway tips 31 are clamped by the periphery of the body 11 of a rotation cutting tool. And conventionally, even if the dimension S of protrusions of the direction (shaft orientations of a spindle) of revolving-shaft G of the lower limit (transverse plane) 13 of the body 11 of a cutting tool and the lower limit 38 of the cutting edge of a throwaway tip (only henceforth a chip) 31, i.e., the amount of the direction of shaft G of the lower limit 38 of a cutting edge, was about 1.5mm and it was large, it just said, it is at most 2.5mm.

[0003] On the other hand, in cutting with this kind of rotation cutting tool 1, cutting advances in the condition of the generated scraps (chip) of having been held between the lower limit (field) 13 of the body 11 of a tool, and the processing side M of a work piece (a two-dot chain line shows) W, without or being discharged a little by the outside of the body 11 of a tool. However, in such a cutting tool 1, since the path clearance of the processing side (cutting side) M and the lower limit 38 of the chip of the body 11 of a tool was rubbed against the processing side M of 1.5-2.5mm and the work piece which the held scraps cut since it was narrow, it gave the blemish (scratch blemish) to the processing side M, and had become the cause which attaches a blemish to a tool. Moreover, depending on the case, it is bit and crowded with an end cutting edge, and the problem of the chipping (breakage) of a chip might be generated. It is possible to enlarge spraying the coolant for scraps discharge, for example on the cutting edge of a chip, and a chip pocket (space) as solution of such a problem, and to raise eccentric [of scraps] etc.

[0004]

[Problem(s) to be Solved by the Invention] However, just such solution is inadequate as a solution of the aforementioned trouble. Because, in the conventional cutting tool, the dimension S of the shaft orientations of the lower limit 13 of the body of a tool and the lower limit 38 of a chip is too small fundamentally, and it is because it is not functioning as a recess path of scraps. In processing the ingredient which especially has stickiness by elasticity comparatively like aluminum or an aluminium alloy, the scraps are hard to be discharged upwards and it is easy to attach a blemish to a processing side for a low degree of hardness [work piece / itself].

[0005] This invention was made in view of such a trouble in the conventional rotation cutting tool, and aims at offering the rotation cutting tool with which the scraps which exist between the lower limit side of the body of a tool and a processing side during cutting can prevent attaching a blemish to a processing side effectively.

[0006]

[Means for Solving the Problem] In order to cancel the aforementioned trouble, this invention according to claim 1 is characterized by setting the dimension in the direction of a revolving shaft of the lower limit of said body of a rotation cutting tool, and the lower limit of the cutting

edge of said clamped throwaway tip to 3.0-4.5mm in the rotation cutting tool with which two or more throwaway tips were clamped by the periphery of the body of a rotation cutting tool.

[0007] According to the rotation cutting tool of this invention, the dimension, i.e., the amount of a chip, of protrusions in the direction of a revolving shaft of the lower limit of the body of a tool and the lower limit of the cutting edge of the throwaway tip clamped (immobilization) is larger than 3.0-4.5mm and that of the conventional tool 1.5-2.0mm. That is, since the path clearance of a processing side and the lower limit of the body of a tool is large, though according to the rotation cutting tool of this invention eccentric [of the scraps to the outside] is raised in cutting, scraps exist between the lower limit of the body of a tool, and a processing side and it is not discharged outside, a blemish is given to the processing side of a work piece, or attaching a blemish to a tool is prevented. And since the amount of protrusions is made into the range which is 3.0-4.5mm, it becomes insufficient [rigidity] and a processing side (cutting side) is not made to generate BIBIRI.

[0008] In said means, said throwaway tip is good for it to be [this clamp hole] unevenly distributed, it to be established in the side approach location which counters the side which makes not a core but the bottom cutting edge of a throwaway tip, for fitting of this clamp hole to be carried out to the heights of a blade, and for said throwaway tip to be clamped through this blade by said body of a rotation cutting tool while it is equipped with the clamp hole. In the case of the tool of the structure which clamps the chip equipped with the clamp hole, in this thing, the number of cutting edges (corner) becomes fewer, but it is because it is not necessary to change clamp structures, such as a blade by the side of the body of a tool, and the conventional body of a tool can be used as it is according to the amount of maldistribution of a clamp hole.

[0009] Although it can be used irrespective of the quality of the material of a work piece, when using for processing of aluminum or an aluminium alloy, especially in order that a blemish may tend to attach the rotation cutting tool concerning this invention to the processing side fundamentally, it is effective. In addition, the thing which comes to unite with a throwaway tip body the extra-high voltage sintered compact which makes a cutting edge as a throwaway tip suitable for processing of such a work piece is desirable. That (diamond sintered compact object (PCD)) to which this extra-high voltage sintered compact uses a diamond as a principal component especially is suitable for processing of aluminum or an aluminium alloy. But the thing which comes to unite a cubic system boron-nitride sintered compact (CBN) with a cutting edge in processing of a high degree-of-hardness ingredient to manufacture by cemented carbide, the ceramic, a cermet, etc. depending on a work piece is desirable.

[0010] In the thing equipped with the clamp hole penetrated to a rake face, the suitable throwaway tip for the rotation cutting tool of this invention is a throwaway tip clamped by the periphery of the body of a rotation cutting tool, and it is established [it is / this clamp hole / unevenly distributed, and] in the side approach location which counters the side which is not the core of the rake face of a throwaway tip and makes a bottom cutting edge. That is, the part in which the clamp hole site was made unevenly distributed, and said rotation cutting tool concerning this invention can consist of easily that it should be unevenly distributed and this clamp hole should be prepared so that the side which counters the side which makes not a core but the bottom cutting edge of a rake face of a throwaway tip might be approached.

[0011]

[Embodiment of the Invention] The operation gestalt of the cutting tool concerning this invention is explained to a detail with reference to drawing 1 - drawing 5 . Among drawing, one is a cutting tool concerning this operation gestalt, and the chip clamp slot 16 is cut in the fixed range upwards from the lower limit 13 of the peripheral face 12 of the body 11 of a tool (cutter body) which makes the shape of an approximate circle column. Two or more these chip clamp slots 16 are established in the circumference of Axis G by the equiangular distance. And it is constituted so that the blade (cartridge) 41 with which degree chip 31 which carries out an account was attached in each chip clamp slot 16 may be thrust into the screw hole 18 which let the clamp screw member 51 pass to the pipe 42, and was established in the bottom 17 of the chip clamp slot 16 and it can clamp. In addition, it is supposed that the periphery approach part of the lower limit 13 of the body 11 of a tool is flat, a groove is cut in the shape of a taper toward a core, and

the mounting hole 20 to a spindle is established in the center section (axis section). As mentioned above, there is no point that body of tool 11 the very thing used for this gestalt differs from the conventional thing.

[0012] On the other hand, the throwaway tip 31 currently used in this gestalt makes an abbreviation parallelogram by fixed thickness, and forms the 2 sides which counter for a long time to the conventional rhombus chip with a hole. That is, the clamp hole 35 of a circle diameter is established in the side approach location which is the center of the cross direction in the long side, and counters the bottom cutting edge 32. The blade 41 which carried out the deer and which was made into the condition of having fitted the clamp hole 35 into the heights (cylinder section) 44 of the chip anchoring section 43 of a blade 41 is set to the chip clamp slot 16, and it is being fixed to the body 11 of a tool by the bell and spigot of the clamp screw member 51. In addition, 61 in drawing 3 is a wedge which presses down the rake face side of a chip 31.

Moreover, 63 is a screw for adjustment of the axial direction, and it is constituted so that it may be thrust into the screw hole 19 established in the bottom 17 of the chip clamp slot 16.

[0013] In addition, low attachment of the diamond sintered compact (PCD) 37 shall be carried out in the lower limit 38 of the angle which the body 32 of a chip consists of cemented carbide, and the bottom cutting edge 32 and the periphery cutting edge 33 make, and the throwaway tip 31 used for this gestalt shall be suitable for processing of aluminum or an aluminium alloy.

[0014] Thus, as for the cutting tool 1 of this gestalt with which the chip 31 was clamped, the dimension S of the direction of revolving-shaft G of the lower limit 38 of a chip 31 and the lower limit 13 of the body 11 of a tool is set as 4.0mm. in addition, two sides which, as for increase of this dimension S of downward protrusions, i.e., the amount of a chip 31, the conventional rhombus chip with a hole counters -- a fixed dimension -- it lengthens for a long time and is the same as that by which low attachment of PCD37 was carried out at the acute-angle section of that lengthened part. Therefore, with this gestalt, only a chip 31 differs from the conventional thing.

[0015] A deer is carried out, such a rotation cutting tool 1 is attached through the fixed screw member which is not illustrated to the spindle of the face cutter board, and it is used for carrying out planing of the work piece (a two-dot chain line showing) W clamped on the table etc. And at the time of the cutting, since 1.5mm or more is larger than 4mm and the former, the path clearance between the processing side M and the lower limit 13 of the body 11 of a tool is also greatly secured for the dimension S of the direction of revolving-shaft G of the lower limit 38 of the cutting edge of a chip 31, and the lower limit 13 of the body 11 of a tool. Therefore, even if eccentric [of the scraps to the outside of a chip 31] is raised in cutting and scraps exist between the lower limit 13 of the body 11 of a tool, and the processing side M, a blemish is given to the processing side M of a work piece W, or attaching a blemish to a tool is prevented.

[0016] Here, the body of a tool considered as the cutting rotation tool of a six-sheet cutting edge for the diameter of 80mm, test cutting of the **ed material was carried out as a block made from aluminum (every direction of 100mm each, die length of 200mm), and the processing side M of a work piece W was investigated. however, cutting conditions are 50mm (50%) in spindle (engine-speed S):10000rpm, table feed-rate (F):3000 mm/min, feed-per-revolution (fz):0.05mm per one cutting edge, amount (depth d):of infeeds3mm, and infeed width of face, and cut **ed material under wet conditions covering die length of 200mm now. in addition, a chip is based on the thing (the inscribed circle of 12.7mm, the amount of protrusions of S:2.5mm) of ISO and CPGA432 type (example of a comparison), and counters based on it -- two sides are lengthened and PCD is united with a corner. The amount S of protrusions was changed as shown in Table 1. Moreover, each periphery cutting-edge angle (corner angle) was made into 0 times. A result is as having been shown in Table 1, and is based on viewing except field roughness.

[0017]

[Table 1]

| チップの下端の 突出量 S (mm) | 加工面の切り屑 による傷跡の有無 | 加工面の面粗度 (Ry : μ m) | 加工面の ビビリの有無 |
|-----------------------|---------------------|---------------------------|----------------|
| 2.5 * | 有 | 6.87 | 無 |
| 3.0 | 無 | 3.53 | 無 |
| 3.5 | 無 | 2.90 | 無 |
| 4.0 | 無 | 2.86 | 無 |
| 4.5 | 無 | 2.34 | 無 |
| 5.0 * | 無 | 5.34 | 有 |
| 5.5 * | 無 | 7.52 | 有 |

*印は比較例である。

[0018] In 2.5mm or less, the scar according [the amount of protrusions] to scraps was seen in the processing side as shown in Table 1. On the other hand, it projected and the scar according [an amount] to scraps to a processing side at 3.0mm or more was not seen. Moreover, also about the field roughness of a processing side, when the amount of protrusions was set to 3.0mm or more, a big reduction was seen. In addition, by 5.0mm or more, BIBIRI was seen for the amount of protrusions in the processing side. From these things, it is understood that it is appropriate for the amount of protrusions of the cutting edge of a chip 31 to be referred to as 3.0-4.5mm.

[0019] This invention sets the dimension in the direction of a revolving shaft of the lower limit of the body of a tool, and the lower limit of the cutting edge of the clamped chip to 3.0-4.5mm, and in the range which does not deviate from the summary, the design change of it is carried out suitably, and it can materialize it. For example, although said gestalt explained by the case where it equips with the chip of a parallelogram, the configuration of the chip which can be used is not limited to this. Furthermore, although a chip is a thing with a hole and was explained, also in what has a nothing hole, it is applicable. Furthermore, what is necessary is just to let the quality of the material of a chip or its cutting edge be a proper thing according to a work piece.

[0020]

[Effect of the Invention] the range which BIBIRI does not produce [the path clearance of a processing side and the lower limit of the body of a tool] in 3.0-4.5mm and a processing side according to the rotation cutting tool of this invention so that clearly from the above explanation -- optimum dose, since it is enlarged Though eccentric [of the scraps to the outside] is raised in cutting, scraps exist between the lower limit of the body of a tool, and a processing side and it is not discharged outside, a blemish is given to the processing side of a work piece, or attaching a blemish to a tool is prevented.

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the rotation cutting tool used for a face cutter (cutter) etc.

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PRIOR ART

[Description of the Prior Art] drawing 6 shows the cross-section structure of this kind of rotation cutting tool (the body of the following and a tool -- or it is also only called a body) 1. As for this tool 1, two or more throwaway tips 31 are clamped by the periphery of the body 11 of a rotation cutting tool. And conventionally, even if the dimension S of protrusions of the direction (shaft orientations of a spindle) of revolving-shaft G of the lower limit (transverse plane) 13 of the body 11 of a cutting tool and the lower limit 38 of the cutting edge of a throwaway tip (only henceforth a chip) 31, i.e., the amount of the direction of shaft G of the lower limit 38 of a cutting edge, was about 1.5mm and it was large, it just said, it is at most 2.5mm.

[0003] On the other hand, in cutting with this kind of rotation cutting tool 1, cutting advances in the condition of the generated scraps (chip) of having been held between the lower limit (field) 13 of the body 11 of a tool, and the processing side M of a work piece (a two-dot chain line shows) W, without or being discharged a little by the outside of the body 11 of a tool. However, in such a cutting tool 1, since the path clearance of the processing side (cutting side) M and the lower limit 38 of the chip of the body 11 of a tool was rubbed against the processing side M of 1.5-2.5mm and the work piece which the held scraps cut since it was narrow, it gave the blemish (scratch blemish) to the processing side M, and had become the cause which attaches a blemish to a tool. Moreover, depending on the case, it is bit and crowded with an end cutting edge, and the problem of the chipping (breakage) of a chip might be generated. It is possible to enlarge spraying the coolant for scraps discharge, for example on the cutting edge of a chip, and a chip pocket (space) as solution of such a problem, and to raise eccentric [of scraps] etc.

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EFFECT OF THE INVENTION

[Effect of the Invention] the range which BIBIRI does not produce [the path clearance of a processing side and the lower limit of the body of a tool] in 3.0-4.5mm and a processing side according to the rotation cutting tool of this invention so that clearly from the above explanation -- optimum dose, since it is enlarged Though eccritic [of the scraps to the outside] is raised in cutting, scraps exist between the lower limit of the body of a tool, and a processing side and it is not discharged outside, a blemish is given to the processing side of a work piece, or attaching a blemish to a tool is prevented.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, just such solution is inadequate as a solution of the aforementioned trouble. Because, in the conventional cutting tool, the dimension S of the shaft orientations of the lower limit 13 of the body of a tool and the lower limit 38 of a chip is too small fundamentally, and it is because it is not functioning as a recess path of scraps. In processing the ingredient which especially has stickiness by elasticity comparatively like aluminum or an aluminium alloy, the scraps are hard to be discharged upwards and it is easy to attach a blemish to a processing side for a low degree of hardness [work piece / itself].

[0005] This invention was made in view of such a trouble in the conventional rotation cutting tool, and aims at offering the rotation cutting tool with which the scraps which exist between the lower limit side of the body of a tool and a processing side during cutting can prevent attaching a blemish to a processing side effectively.

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MEANS

[Means for Solving the Problem] In order to cancel the aforementioned trouble, this invention according to claim 1 is characterized by setting the dimension in the direction of a revolving shaft of the lower limit of said body of a rotation cutting tool, and the lower limit of the cutting edge of said clamped throwaway tip to 3.0-4.5mm in the rotation cutting tool with which two or more throwaway tips were clamped by the periphery of the body of a rotation cutting tool. [0007] According to the rotation cutting tool of this invention, the dimension, i.e., the amount of a chip, of protrusions in the direction of a revolving shaft of the lower limit of the body of a tool and the lower limit of the cutting edge of the throwaway tip clamped (immobilization) is larger than 3.0-4.5mm and that of the conventional tool 1.5-2.0mm. That is, since the path clearance of a processing side and the lower limit of the body of a tool is large, though according to the rotation cutting tool of this invention eccentric [of the scraps to the outside] is raised in cutting, scraps exist between the lower limit of the body of a tool, and a processing side and it is not discharged outside, a blemish is given to the processing side of a work piece, or attaching a blemish to a tool is prevented. And since the amount of protrusions is made into the range which is 3.0-4.5mm, it becomes insufficient [rigidity] and a processing side (cutting side) is not made to generate BIBIRI.

[0008] In said means, said throwaway tip is good for it to be [this clamp hole] unevenly distributed, it to be established in the side approach location which counters the side which makes not a core but the bottom cutting edge of a throwaway tip, for fitting of this clamp hole to be carried out to the heights of a blade, and for said throwaway tip to be clamped through this blade by said body of a rotation cutting tool while it is equipped with the clamp hole. In the case of the tool of the structure which clamps the chip equipped with the clamp hole, in this thing, the number of cutting edges (corner) becomes fewer, but it is because it is not necessary to change clamp structures, such as a blade by the side of the body of a tool, and the conventional body of a tool can be used as it is according to the amount of maldistribution of a clamp hole.

[0009] Although it can be used irrespective of the quality of the material of a work piece, when using for processing of aluminum or an aluminium alloy, especially in order that a blemish may tend to attach the rotation cutting tool concerning this invention to the processing side fundamentally, it is effective. In addition, the thing which comes to unite with a throwaway tip body the extra-high voltage sintered compact which makes a cutting edge as a throwaway tip suitable for processing of such a work piece is desirable. That (diamond sintered compact object (PCD)) to which this extra-high voltage sintered compact uses a diamond as a principal component especially is suitable for processing of aluminum or an aluminium alloy. But the thing which comes to unite a cubic system boron-nitride sintered compact (CBN) with a cutting edge in processing of a high degree-of-hardness ingredient to manufacture by cemented carbide, the ceramic, a cermet, etc. depending on a work piece is desirable.

[0010] In the thing equipped with the clamp hole penetrated to a rake face, the suitable throwaway tip for the rotation cutting tool of this invention is a throwaway tip clamped by the periphery of the body of a rotation cutting tool, and it is established [it is / this clamp hole / unevenly distributed, and] in the side approach location which counters the side which is not the core of the rake face of a throwaway tip and makes a bottom cutting edge. That is, the part

in which the clamp hole site was made unevenly distributed, and said rotation cutting tool concerning this invention can consist of easily that it should be unevenly distributed and this clamp hole should be prepared so that the side which counters the side which makes not a core but the bottom cutting edge of a rake face of a throwaway tip might be approached.

[0011]

[Embodiment of the Invention] The operation gestalt of the cutting tool concerning this invention is explained to a detail with reference to drawing 1 - drawing 5. Among drawing, one is a cutting tool concerning this operation gestalt, and the chip clamp slot 16 is cut in the fixed range upwards from the lower limit 13 of the peripheral face 12 of the body 11 of a tool (cutter body) which makes the shape of an approximate circle column. Two or more these chip clamp slots 16 are established in the circumference of Axis G by the equiangular distance. And it is constituted so that the blade (cartridge) 41 with which degree chip 31 which carries out an account was attached in each chip clamp slot 16 may be thrust into the screw hole 18 which let the clamp screw member 51 pass to the pipe 42, and was established in the bottom 17 of the chip clamp slot 16 and it can clamp. In addition, it is supposed that the periphery approach part of the lower limit 13 of the body 11 of a tool is flat, a groove is cut in the shape of a taper toward a core, and the mounting hole 20 to a spindle is established in the center section (axis section). As mentioned above, there is no point that body of tool 11 the very thing used for this gestalt differs from the conventional thing.

[0012] On the other hand, the throwaway tip 31 currently used in this gestalt makes an abbreviation parallelogram by fixed thickness, and forms the 2 sides which counter for a long time to the conventional rhombus chip with a hole. That is, the clamp hole 35 of a circle diameter is established in the side approach location which is the center of the cross direction in the long side, and counters the bottom cutting edge 32. The blade 41 which carried out the deer and which was made into the condition of having fitted the clamp hole 35 into the heights (cylinder section) 44 of the chip anchoring section 43 of a blade 41 is set to the chip clamp slot 16, and it is being fixed to the body 11 of a tool by the bell and spigot of the clamp screw member 51. In addition, 61 in drawing 3 is a wedge which presses down the rake face side of a chip 31. Moreover, 63 is a screw for adjustment of the axial direction, and it is constituted so that it may be thrust into the screw hole 19 established in the bottom 17 of the chip clamp slot 16.

[0013] In addition, low attachment of the diamond sintered compact (PCD) 37 shall be carried out in the lower limit 38 of the angle which the body 32 of a chip consists of cemented carbide, and the bottom cutting edge 32 and the periphery cutting edge 33 make, and the throwaway tip 31 used for this gestalt shall be suitable for processing of aluminum or an aluminium alloy.

[0014] Thus, as for the cutting tool 1 of this gestalt with which the chip 31 was clamped, the dimension S of the direction of revolving-shaft G of the lower limit 38 of a chip 31 and the lower limit 13 of the body 11 of a tool is set as 4.0mm. in addition, two sides which, as for increase of this dimension S of downward protrusions, i.e., the amount of a chip 31, the conventional rhombus chip with a hole counters -- a fixed dimension -- it lengthens for a long time and is the same as that by which low attachment of PCD37 was carried out at the acute-angle section of that lengthened part. Therefore, with this gestalt, only a chip 31 differs from the conventional thing.

[0015] A deer is carried out, such a rotation cutting tool 1 is attached through the fixed screw member which is not illustrated to the spindle of the face cutter board, and it is used for carrying out planing of the work piece (a two-dot chain line showing) W clamped on the table etc. And at the time of the cutting, since 1.5mm or more is larger than 4mm and the former, the path clearance between the processing side M and the lower limit 13 of the body 11 of a tool is also greatly secured for the dimension S of the direction of revolving-shaft G of the lower limit 38 of the cutting edge of a chip 31, and the lower limit 13 of the body 11 of a tool. Therefore, even if eccentric [of the scraps to the outside of a chip 31] is raised in cutting and scraps exist between the lower limit 13 of the body 11 of a tool, and the processing side M, a blemish is given to the processing side M of a work piece W, or attaching a blemish to a tool is prevented.

[0016] Here, the body of a tool considered as the cutting rotation tool of a six-sheet cutting edge for the diameter of 80mm, test cutting of the *-ed material was carried out as a block

made from aluminum (every direction of 100mm each, die length of 200mm), and the processing side M of a work piece W was investigated. however, cutting conditions are 50mm (50%) in spindle (engine-speed S):10000rpm, table feed-rate (F):3000 mm/min, feed-per-revolution (fz):0.05mm per one cutting edge, amount (depth d):of infeeds3mm, and infeed width of face, and cut **ed material under wet conditions covering die length of 200mm now. in addition, a chip is based on the thing (the inscribed circle of 12.7mm, the amount of protrusions of S:2.5mm) of ISO and CPGA432 type (example of a comparison), and counters based on it -- two sides are lengthened and PCD is united with a corner. The amount S of protrusions was changed as shown in Table 1. Moreover, each periphery cutting-edge angle (corner angle) was made into 0 times. A result is as having been shown in Table 1, and is based on viewing except field roughness.

[0017]

[Table 1]

| チップの下端の 突出量 S (mm) | 加工面の切り屑 による傷跡の有無 | 加工面の面粗度 (Ry : μm) | 加工面の ビビリの有無 |
|-----------------------|---------------------|----------------------------------|----------------|
| 2.5 * | 有 | 6.87 | 無 |
| 3.0 | 無 | 3.53 | 無 |
| 3.5 | 無 | 2.90 | 無 |
| 4.0 | 無 | 2.86 | 無 |
| 4.5 | 無 | 2.34 | 無 |
| 5.0 * | 無 | 5.34 | 有 |
| 5.5 * | 無 | 7.52 | 有 |

*印は比較例である。

[0018] In 2.5mm or less, the scar according [the amount of protrusions] to scraps was seen in the processing side as shown in Table 1. On the other hand, it projected and the scar according [an amount] to scraps to a processing side at 3.0mm or more was not seen. Moreover, also about the field roughness of a processing side, when the amount of protrusions was set to 3.0mm or more, a big reduction was seen. In addition, by 5.0mm or more, BIBIRI was seen for the amount of protrusions in the processing side. From these things, it is understood that it is appropriate for the amount of protrusions of the cutting edge of a chip 31 to be referred to as 3.0-4.5mm.

[0019] This invention sets the dimension in the direction of a revolving shaft of the lower limit of the body of a tool, and the lower limit of the cutting edge of the clamped chip to 3.0-4.5mm, and in the range which does not deviate from the summary, the design change of it is carried out suitably, and it can materialize it. For example, although said gestalt explained by the case where it equips with the chip of a parallelogram, the configuration of the chip which can be used is not limited to this. Furthermore, although a chip is a thing with a hole and was explained, also in what has a nothing hole, it is applicable. Furthermore, what is necessary is just to let the quality of the material of a chip or its cutting edge be a proper thing according to a work piece.

[Translation done.]

* NOTICES *

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] Central drawing of longitudinal section of the body of a tool which constitutes the rotation cutting tool of this invention, and drawing explaining the physical relationship of the lower limit and chip lower limit.

[Drawing 2] Central drawing of longitudinal section of the rotation cutting tool of this invention.

[Drawing 3] The partial side elevation of drawing 2 .

[Drawing 4] Drawing and B as which A regarded the chip from the rake face side before the clamp set to the blade are a decomposition right side view before the set of A.

[Drawing 5] The expansion front view of the throwaway tip used for the rotation cutting tool of this invention.

[Drawing 6] Central drawing of longitudinal section explaining the physical relationship of the lower limit of the chip of the conventional rotation cutting tool, and the lower limit of the body of a tool.

[Description of Notations]

1 Rotation Cutting Tool

11 Body of Rotation Cutting Tool

13 Lower Limit of Body of Rotation Cutting Tool

31 Throwaway Tip

32 Bottom Cutting Edge of Throwaway Tip

35 Clamp Hole of Throwaway Tip

37 Extra-high Voltage Sintered Compact

38 Lower Limit of Cutting Edge of Throwaway Tip

41 Blade

44 Heights of Blade

G Revolving shaft

S The dimension of the direction of a revolving shaft of the lower limit of the body of a tool, and the lower limit of the cutting edge of a chip

[Translation done.]

* NOTICES *

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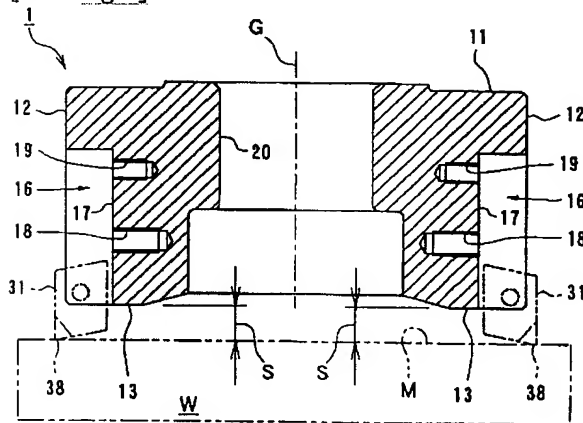
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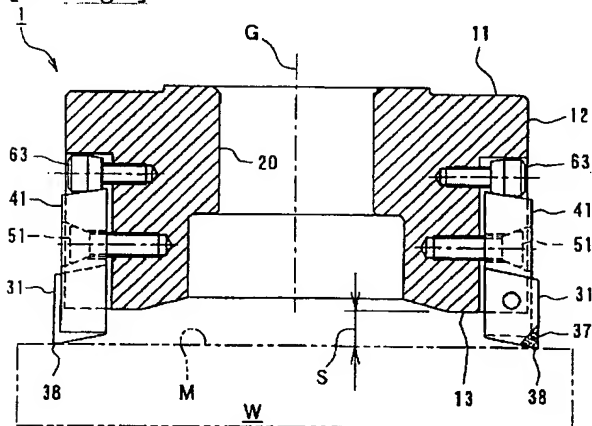
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DRAWINGS

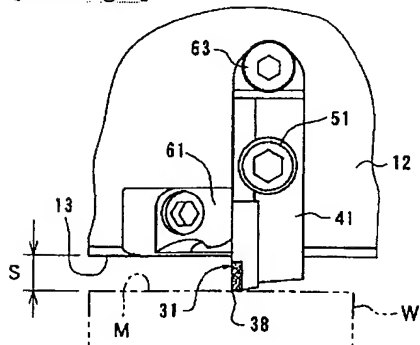
[Drawing 1]



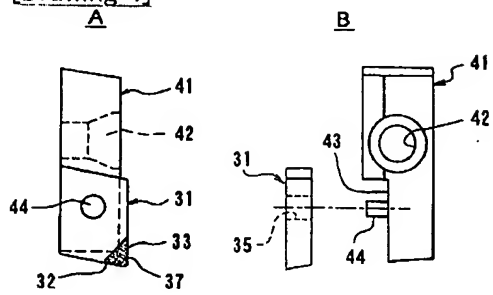
[Drawing 2]



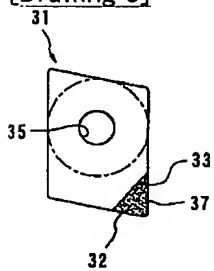
[Drawing 3]



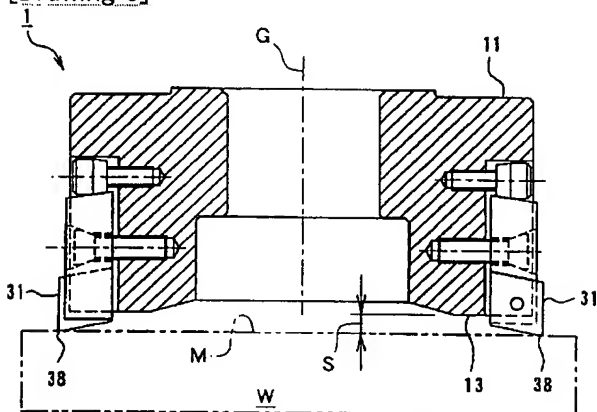
[Drawing 4]



[Drawing 5]



[Drawing 6]



[Translation done.]

JP2001239416

Title:
ROTARY CUTTING TOOL

Abstract:

PROBLEM TO BE SOLVED: To provide a rotary cutting tool capable of preventing chips existing between the bottom surface and a machining surface of a tool body from damaging the machining surface during cutting. **SOLUTION:** In the rotary cutting tool 1, a plurality of throw-away tips 31 are clamped to the outer periphery of the tool body 11. A size S of a clearance in the rotation shaft G direction between the lower end 13 of the cutting tool body 11 and the lower end 38 of a cutting edge of the clamped tips 31 is set 3.0-4.5 mm. The clearance is set to be adequately large as long as chattering does not occur in the machining surface, so that the chips are prevented from damaging the machining surface of a work.

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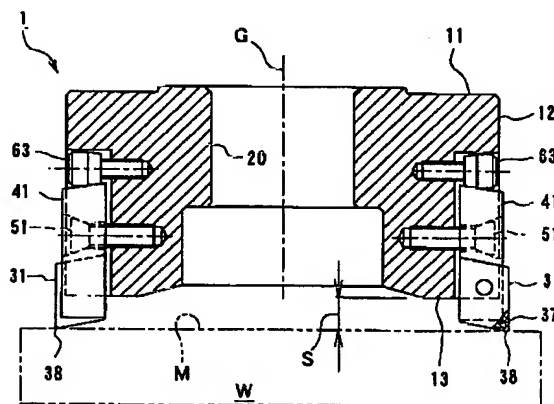
LL03 MM04 MM05

(54) 【発明の名称】 回転切削工具

(57) 【要約】

【課題】 切削中、工具本体の下端面と加工面との間に存在する切り屑が加工面に傷を付けることを防止できる回転切削工具を提供する。

【解決手段】 工具本体 11 の外周に複数のスローアウェイチップ 31 がクランプされた回転切削工具 1 で、切削工具本体 11 の下端 13 と、クランプされたチップ 31 の切れ刃の下端 38 との回転軸 G 方向におけるクリアランス寸法 S を、3.0～4.5 mm とした。クリアランスが、加工面にビビリが生じない範囲で適量大きくされているため、切り屑がワークの加工面に傷をつけることが防止される。



【特許請求の範囲】

【請求項1】 回転切削工具本体の外周に複数のスローアウェイチップがクランプされた回転切削工具において、前記回転切削工具本体の下端と、クランプされた前記スローアウェイチップの切れ刃の下端との回転軸方向における寸法を、3.0～4.5mmとしたことを特徴とする回転切削工具。

【請求項2】 前記スローアウェイチップはクランプ穴を備えていると共に、該クランプ穴が、スローアウェイチップの中心でなく底切れ刃をなす辺に対向する辺寄り位置に偏在して設けられており、該クランプ穴がブレードの凸部に嵌合され、該ブレードを介して前記スローアウェイチップが前記回転切削工具本体にクランプされていることを特徴とする請求項1記載の回転切削工具。

【請求項3】 前記スローアウェイチップは、スローアウェイチップ本体に切れ刃をなす超高压焼結体が一体化されてなるものである請求項1又は2記載の回転切削工具。

【請求項4】 前記超高压焼結体がダイヤモンドを主成分とするものである請求項3記載の回転切削工具。

【請求項5】 回転切削工具本体の外周にクランプされるスローアウェイチップであって、すくい面に貫通するクランプ穴を備えているものにおいて、該クランプ穴が、スローアウェイチップのすくい面の中心でなく、底切れ刃をなす辺に対向する辺寄り位置に偏在して設けられていることを特徴とするスローアウェイチップ。

【請求項6】 請求項5において、スローアウェイチップ本体に切れ刃をなす超高压焼結体が一体化されてなることを特徴とするスローアウェイチップ。

【請求項7】 前記超高压焼結体がダイヤモンドを主成分とするものである請求項6記載のスローアウェイチップ。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、正面フライス（カッター）等を使用される回転切削工具に関する。

【0002】

【従来の技術】図6は、この種の回転切削工具（以下、工具本体又は単に本体ともいう）1の断面構造を示したものである。この工具1は、回転切削工具本体11の外周に複数のスローアウェイチップ31がクランプされている。そして、切削工具本体11の下端（正面）13と、スローアウェイチップ（以下、単にチップともいう）31の切れ刃の下端38との回転軸G方向（スピンドルの軸方向）の寸法、すなわち切れ刃の下端38の軸G方向の突出量Sは、従来、1.5mm程度であり、大きくてもせいぜい2.5mmといったところである。

【0003】一方、この種の回転切削工具1で切削する場合には、発生する切り屑（切粉）の幾分かが工具本体11の外側に排出されることなく、工具本体11の下端

（面）13とワーク（2点鎖線で示す）Wの加工面Mとの間に抱え込まれた状態で切削が進行する。ところが、このような切削工具1では、加工面（切削面）Mと工具本体11のチップの下端38とのクリアランスは1.5～2.5mmと狭いため、抱え込まれた切り屑が切削したワークの加工面Mに擦り付けられるため、加工面Mに傷（スクラッチ傷）をつけたり、工具に傷を付ける原因となっていた。また、場合によっては切り刃にかみこまれてチップのチップング（破損）といった問題を発生させることもあった。こうした問題の解決法としては、例えばチップの切れ刃に切り屑排出用のクーラントを吹き付けることやチップポケット（空間）を大きくして切り屑の排出性を高めることなどが考えられる。

【0004】

【発明が解決しようとする課題】ところが、こうした解決法だけでは、前記の問題点の解決策としては不十分である。というのは、従来の切削工具においては、工具本体の下端13とチップの下端38との軸方向の寸法Sが基本的に小さすぎ、切り屑の逃げ道として機能していないためである。とりわけアルミニウムやアルミニウム合金のように比較的軟質で粘りのある材料を加工する場合には、その切り屑が排出され難い上に、ワーク自体が低硬度のために加工面に傷がつきやすい。

【0005】本発明は、従来の回転切削工具におけるこうした問題点に鑑みてなされたもので、切削中において工具本体の下端面と加工面との間に存在する切り屑が加工面に傷を付けるといったことを効果的に防止できる回転切削工具を提供することを目的とする。

【0006】

【課題を解決するための手段】前記の問題点を解消するために請求項1記載の本発明は、回転切削工具本体の外周に複数のスローアウェイチップがクランプされた回転切削工具において、前記回転切削工具本体の下端と、クランプされた前記スローアウェイチップの切れ刃の下端との回転軸方向における寸法を、3.0～4.5mmとしたことを特徴とする。

【0007】本発明の回転切削工具によれば、工具本体の下端とクランプ（固定）されたスローアウェイチップの切れ刃の下端との回転軸方向における寸法つまりチップの突出量が、3.0～4.5mmと、従来の工具のそれより1.5～2.0mm大きい。すなわち、本発明の回転切削工具によれば、加工面と工具本体の下端とのクリアランスが大きいため、切削においてその外側への切り屑の排出性が高められるし、工具本体の下端と加工面との間に切り屑が存在し、外側に排出されないとしても、ワークの加工面に傷をつけたり、工具に傷を付けることが防止される。しかも、その突出量が3.0～4.5mmの範囲とされていることから、剛性不足となつて加工面（切削面）にビビリを発生させることもない。

【0008】前記手段において、前記スローアウェイチ

チップはクランプ穴を備えていると共に、該クランプ穴が、スローアウェイチップの中心でなく底切れ刃をなす辺に対向する辺寄り位置に偏在して設けられており、該クランプ穴がブレードの凸部に嵌合され、該ブレードを介して前記スローアウェイチップが前記回転切削工具本体にクランプされているものとする。このものでは、クランプ穴を備えたチップをクランプする構造の工具の場合、切れ刃（コーナー）の数は減るが、工具本体側のブレードなどのクランプ構造を変更するまでもなく、クランプ穴の偏在量次第で従来の工具本体をそのまま使用できるためである。

【0009】本発明に係る回転切削工具は、ワークの材質に拘らず使用できるが、アルミニウム又はアルミニウム合金の加工に用いる場合においては、基本的にその加工面に傷がつきやすいため特に有効である。なお、このようなワークの加工に適するスローアウェイチップとしては、スローアウェイチップ本体に切れ刃をなす超高压焼結体が一体化されてなるものが好ましい。とくに、該超高压焼結体がダイヤモンドを主成分とするもの（ダイヤモンド焼結体（PCD））がアルミニウム又はアルミニウム合金の加工用に適する。もっとも、ワークによっては超硬合金、セラミック、サーメットなどで製造すればよいし、高硬度材料の加工においては切れ刃に立方晶窒化ほう素焼結体（CBN）が一体化されてなるものが好ましい。

【0010】本発明の回転切削工具に好適なスローアウェイチップは、回転切削工具本体の外周にクランプされるスローアウェイチップであって、すくい面に貫通するクランプ穴を備えているものにおいて、該クランプ穴が、スローアウェイチップのすくい面の中心でなく、底切れ刃をなす辺に対向する辺寄り位置に偏在して設けられているものである。すなわち、該クランプ穴が、スローアウェイチップのすくい面の中心でなく、底切れ刃をなす辺に対向する辺に近接するように偏在して設けられたものとする。このことで、クランプ穴の位置を偏在させた分、本発明に係る前記回転切削工具を容易に構成することができる。

【0011】

【発明の実施の形態】本発明に係る切削工具の実施形態について、図1～図5を参照して詳細に説明する。図中、1は本実施形態に係る切削工具であり、略円柱状をなす工具本体（カッターボディ）11の外周面12の下端13から上に一定範囲でチップクランプ溝16が凹設されている。このチップクランプ溝16は、軸線G回りに等角度間隔で複数設けられている。そして、各チップクランプ溝16には、次記するチップ31が取付けられたブレード（カートリッジ）41を、その空穴42にクランプネジ部材51をとおり、チップクランプ溝16の底17に設けられたネジ穴18にねじ込んでクランプできるように構成されている。なお、工具本体11の下端

13は、その外周寄り部位が平坦とされ、中心に向かってテーパ状に凹設され、中央部（軸線部）にはスピンドルへの取付け穴20が設けられている。以上、本形態に用いる工具本体11自体は、従来のものと異なる点はない。

【0012】一方、本形態において使用されているスローアウェイチップ31は、一定厚さで略平行四辺形をなすものであり、従来の穴付きひし形チップに対し、対向する2辺を長く形成したものである。すなわち、円径のクランプ穴35は、その長辺における幅方向の中央であって底切れ刃32に対向する辺寄り位置に設けられている。しかして、ブレード41のチップ取付け部43の凸部（円柱部）44にそのクランプ穴35を嵌合した状態としたブレード41を、チップクランプ溝16にセットし、クランプネジ部材51のねじ込みにより工具本体11に固定されている。なお、図3中61は、チップ31のすくい面側を押えるウエッジである。また63は、アキシャル方向の調整用のネジであり、チップクランプ溝16の底17に設けられたネジ穴19にねじ込まれるように構成されている。

【0013】なお、本形態に使用したスローアウェイチップ31は、チップ本体32が超硬合金からなり、底切れ刃32と外周切れ刃33のなす角の下端38にはダイヤモンド焼結体（PCD）37がロウ付けされており、アルミニウム又はアルミニウム合金の加工に適するものとされている。

【0014】このようにチップ31がクランプされた本形態の切削工具1は、チップ31の下端38と、工具本体11の下端13との回転軸G方向の寸法Sが、例えば4.0mmに設定されている。なお、この寸法Sつまりチップ31の下向き突出量の増大は、従来の穴付きひし形チップの対向する2辺を一定寸法長く伸ばし、その伸ばされた部位の鋭角部にPCD37がロウ付けされたものと同じである。したがって、本形態ではチップ31のみが従来のものと異なる。

【0015】しかして、このような回転切削工具1は、正面フライス盤のスピンドルに図示しない固定ネジ部材を介して取付けられ、テーブル上にクランプされたワーク（2点鎖線で示す）Wを平削りするなどに使用される。そして、その切削時には、チップ31の切れ刃の下端38と、工具本体11の下端13との回転軸G方向の寸法Sが4mmと従来よりも1.5ミリ以上も大きいため、加工面Mと工具本体11の下端13との間のクリアランスも大きく確保される。したがって、切削においてチップ31の外側への切り屑の排出性が高められるし、工具本体11の下端13と加工面Mとの間に切り屑が存在しても、ワークWの加工面Mに傷をつけたり、工具に傷を付けることが防止される。

【0016】ここで、工具本体が直径80mmで6枚刃の切削回転工具とし、被削材をアルミニウム製のブロッ

ク（縦横各100mm、長さ200mm）として試験切削して、ワークWの加工面Mを調べてみた。ただし、切削条件は、スピンドル回転数（S）：10000rpm、テーブル送り速度（F）：3000mm/min、1刃当りの送り量（fz）：0.05mm、切込み量（深さd）：3mm、切込み幅50mm（50%）であり、これで被削材を長さ200mmにわたってウェット条件下で切削した。なお、チップは、ISO、CPGA 432タイプのもの（内接円12.7mm、突出量S：

2.5mm）を基本（比較例）とし、それをベースに対向する2辺を長くしてコーナーにPCDを一体化したものである。突出量Sは表1のように変えた。また外周切れ刃角（コーナ角）はいずれも0度とした。結果は表1に示したとおりであり、面粗度以外は目視によるものである。

【0017】

【表1】

| チップの下端の突出量S（mm） | 加工面の切り屑による傷跡の有無 | 加工面の面粗度（Ry：μm） | 加工面のビビリの有無 |
|-----------------|-----------------|----------------|------------|
| 2.5 * | 有 | 6.87 | 無 |
| 3.0 | 無 | 3.53 | 無 |
| 3.5 | 無 | 2.90 | 無 |
| 4.0 | 無 | 2.86 | 無 |
| 4.5 | 無 | 2.34 | 無 |
| 5.0 * | 無 | 5.34 | 有 |
| 5.5 * | 無 | 7.52 | 有 |

*印は比較例である。

【0018】表1に示したとおり、突出量が2.5mm以下では、加工面に切り屑による傷跡がみられた。これに対して突出量が3.0mm以上では、加工面に切り屑による傷跡はみられなかった。また、加工面の面粗度についても、突出量が3.0mm以上になると大きな減少がみられた。なお、突出量が5.0mm以上では、加工面にビビリがみられた。これらのことより、チップ31の切れ刃の突出量は3.0～4.5mmとするのが適切であることが理解される。

【0019】本発明は、工具本体の下端と、クランプされたチップの切れ刃の下端との回転軸方向における寸法を、3.0～4.5mmにしたものであり、その要旨を逸脱しない範囲において適宜に設計変更して具体化できる。例えば前記形態では、平行四辺形のチップを装着した場合で説明したが、使用できるチップの形状はこれに限定されるものではない。さらに、チップは穴付きのもので説明したが、穴なしのものにおいても適用できる。さらに、チップ又はその切れ刃の材質はワークに応じて適宜のものとすればよい。

【0020】

【発明の効果】以上の説明から明らかなように本発明の回転切削工具によれば、加工面と工具本体の下端とのクリアランスが3.0～4.5mmと、加工面にビビリが生じない範囲で適量大きくされているため、切削においてその外側への切り屑の排出性が高められるし、工具本体の下端と加工面との間に切り屑が存在し、外側に排出されないとしても、ワークの加工面に傷をつけたり、工具に傷を付けることが防止される。

【図面の簡単な説明】

【図1】本発明の回転切削工具を構成する工具本体の中央縦断面図、及びその下端とチップ下端の位置関係を説明する図。

【図2】本発明の回転切削工具の中央縦断面図。

【図3】図2の部分側面図。

【図4】Aは、チップをブレードにセットしたクランプ前のすくい面側からみた図、BはAのセット前の分解右側面図。

【図5】本発明の回転切削工具に使用したスローアウェイチップの拡大正面図。

【図6】従来の回転切削工具のチップの下端と工具本体の下端の位置関係を説明する中央縦断面図。

【符号の説明】

1 回転切削工具

11 回転切削工具本体

13 回転切削工具本体の下端

31 スローアウェイチップ

32 スローアウェイチップの底切れ刃

35 スローアウェイチップのクランプ穴

37 超高压焼結体

38 スローアウェイチップの切れ刃の下端

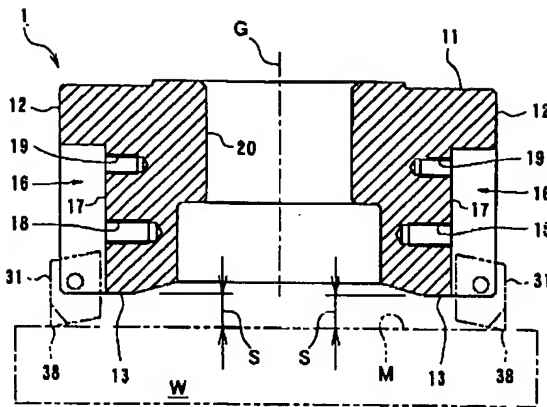
41 ブレード

44 ブレードの凸部

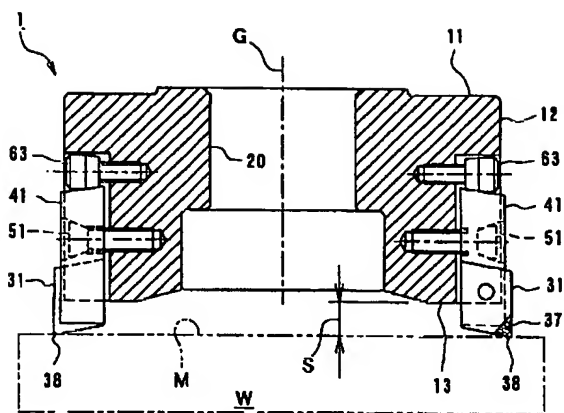
G 回転軸

S 工具本体の下端と、チップの切れ刃の下端との回転軸方向の寸法

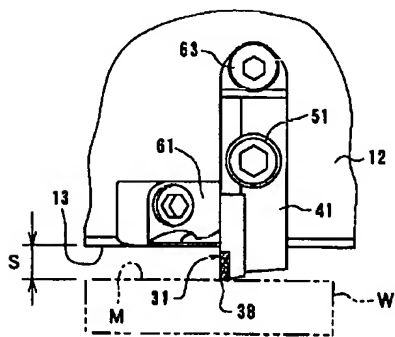
【図1】



【図2】



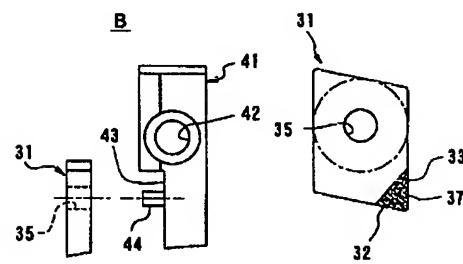
【図3】



【図4】



【図5】



【図6】

